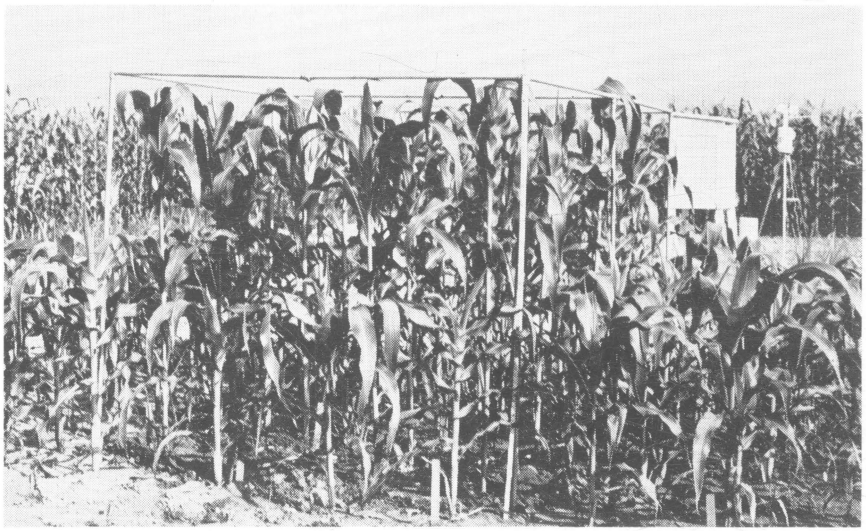
RESEARCH CIRCULAR 178 FEBRUARY 1970

Performance of Corn Hybrids Under Maize Dwarf Mosaic in Ohio in 1969

W. R. FINDLEY, E. J. DOLLINGER, G. J. RYDER,
A. J. BAXTER, and L. N. SHEPHERD



OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER
WOOSTER, OHIO

CONTENTS

* *

Introduction 3

Experimental Procedure 3

Results 4

Conclusions 6

ON THE COVER

Effects of MDM on plant development. Plants inside and surrounding the frame are of the same susceptible hybrid. Those inside the frame were protected from insect inoculation by a fine mesh screen. The screen was removed a few days before the picture was taken.

AGDEX 111/632 2-70-5M

Performance of Corn Hybrids Under Maize Dwarf Mosaic in Ohio in 1969[1]

W. R. FINDLEY, E. J. DOLLINGER, G. J. RYDER, A. J. BAXTER, and L. N. SHEPHERD[2]

INTRODUCTION

In 1969, corn hybrids were grown on the Vaughters' farm along the Ohio River near Portsmouth, Ohio, for yield and other performance data. Incidence of maize dwarf mosaic (MDM) virus was particularly high.

This was a cooperative test conducted by the U. S. Department of Agriculture, Ohio Agricultural Research and Development Center, and Ohio Cooperative Extension Service. A similar hybrid test was grown in the same location in 1968.

The test included 33 hybrids from commercial interests, some of which were experimental combinations, and 5 open-pedigree experimental combinations from the Ohio Agricultural Research and Development Center.

Rainfall distribution and temperatures throughout the growing season were favorable for corn production. A heavy windstorm occurred in the area on August 9. MDM infection reached 100 percent in susceptible trap plants by mid-June and remained at this level during the season.

EXPERIMENTAL PROCEDURE

In accordance with soil test results, fertilizer was applied for a yield goal of 150 bushels per acre. Two hundred pounds of nitrogen in the form of ammonium nitrate were disked into the soil and 300 pounds of 6-24-24 were applied in the row at planting time.

Hybrids were planted May 21 in four replications of two-row plots, with 3-foot isles between each tier of plots. Rows were spaced 40 inches apart and plots, including the isle, were 22 feet long (1/297-acre). Two seeds were hand planted at spacings approximating 10 inches. Each

[1]Cooperative investigations of the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture; the Ohio Agricultural Research and Development Center, Wooster; and Ohio Cooperative Extension Service.

[2]Research Agronomist, Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture; Professor of Agronomy, Ohio Agricultural Research and Development Center; Extension Agronomist, The Ohio State University; Area Extension Agent, Agronomy, Washington Court House; and Extension Agronomist, The Ohio State University, Columbus.

row of each two-row plot was thinned to 27 plants (16,038 plants per acre).

The planting was kept weed-free by a pre-emergence application of herbicide and some hoeing.

Ear height means were determined by measuring 10 random plants in each row from ground level to the top ear node.

Lodging data were recorded at harvest time. Plants broken below the top ear node were counted as stalk-lodged. Root-lodged plants were those plants leaning 45 degree or more from upright. A plant which was both root-lodged and stalk-lodged was counted in both categories. The percentage was calculated on the total number of plants present.

Ears from each hybrid row were harvested and sampled for moisture. The ears from the test were harvested October 13 and 14. All ears in each row were harvested by hand and their weight to the nearest 1/10 pound was recorded.

Grain for moisture determinations was obtained by shelling two kernel rows from ten randomly selected ears. An effort was made to exclude ears which were in contact with the soil on lodged plants and from plants which lodged prematurely. Grain moisture in the samples was allowed sufficient time to equalize in polyethylene bags before it was determined with a Steinlite moisture meter. Hybrid yields were adjusted to 15.5 percent moisture.

Hybrid plot MDM ratings were made on August 27 and September 10 by using a 1 to 9 scale, ranging from 1.0 with no visible symptoms to 9.0 with severe symptoms. Plant stunting, or height reduction due to compressed upper internodes, was not associated with virus ratings of 3.0 or less. Ratings of 4 to 9 indicated increasing degrees of stunting. Ratings of 6 to 9, in addition to stunting, indicated increasing effects of virus on ear shoot development. Plants which rated 9.0 were severely stunted and had little or no ear shoot development.

RESULTS

Average performance of all hybrids tested in 1969 is given in Table 1. Hybrids are grouped by yellow and white kernel types. In Table 2, the 2-year average performance of the 13 hybrids tested in 1968 and 1969 is listed.

Symptoms of MDM due to natural infection appeared to some degree in all hybrids included in the 1969 test. Hybrids tested in both years rated more susceptible to MDM in 1969. By July 11, MDM symptoms were detected in many susceptible plants but were not suffi-

ciently distinct for making ratings. When the ratings were made, MDM symptoms were severe in susceptible strains.

Hybrids were shown to rank the same for yield level in each replication by the analysis of variance. The hybrid x replication mean square value was statistically non-significant when tested by the within two-row plot mean square value. Yields of the more resistant hybrids were considerably below the soil fertility goal of 150 bushels per acre. This may be partially due to the high incidence of MDM, since climatic conditions did not appear to be limiting. Test uniformity was satisfactory as indicated by the coefficient of variation value of 11.8 percent.

Hybrid yield reduction was associated to a high degree with increase in virus susceptibility. Correlation coefficients (r values)[3] between yields and the August 27 and September 10 MDM ratings were —0.69 and —0.67, respectively. These values are significant at the 1 percent probability level. Failure to obtain r values near —1 reflects inadequacies in the rating scheme and tolerance of certain hybrids to virus infection.

Stalk-lodging percentages were excessive for a number of the hybrids. A soft rot developed in the basal stalk portion, resulting in breakage in this region as early as mid-August. The rot was associated with susceptibility to MDM. This association was indicated by r values calculated from the percentage of stalk-lodged plants and the virus ratings of August 27 and September 10. The two r values were 0.51 and 0.33, respectively. Both values are significant at the 1 percent probability level. The high wind of August 9 contributed to increased lodging in some hybrids.

Plants which stalk-lodged between the dates of the first and second MDM ratings could not be scored for MDM at the later date. This could account for the lower r value in the September ratings and for the more susceptible ratings of several hybrids in August.

If the plants had been mechanically harvested, the picker head would have missed many ears on the stalk-lodged plants. Early lodging resulted in poorly developed grain and ear deterioration from the long period of contact with the soil. Yield reduction was indicated to be closely associated with increased stalk-lodging percentage by the r value of 0.62.

Least significant differences (L.S.D.) at the 5 percent probability levels were computed for acre yields, percent moisture at harvest, stalk-

[3]The correlation coefficient (r value) may be any value between +1 and —1. The r value is not affected by units in which the characters are measured. If r is zero, the two factors are independent; the nearer r approaches ±1, the greater the degree of correlation. A negative sign indicates the value of one character increases as the other decreases.

lodging percentages, ear heights, and MDM ratings. The L.S.D. is useful in interpreting the results because it indicates the magnitude of the difference calculated to be real and not due to chance 19 times in 20. Comparisons by the L.S.D. are most meaningful when made by using a common standard.

CONCLUSIONS

Since hybrid entries may vary in performance under different seasonal conditions, data are considered more reliable when collected for more than 1 year. Hybrids with good 2-year performance records show some degree of consistency.

When selecting a hybrid, comparisons should be made on other factors in addition to yield. Moisture in the grain at harvest and mid-silk dates are important from the standpoint of hybrid maturity. Stalk-lodging is particularly important, as many ears on down stalks may be missed by the picker head. The MDM rating should be considered if the hybrid is to be grown in an area where the disease occurs. Other attributes being equal, low ear height is desirable, as the tendency to lodge due to wind is reduced.

Seed of the hybrids which were experimental combinations probably will not be available for farmer planting in 1970. When obtaining seed of any of the hybrids tested, it will be wise to ascertain whether changes have occurred which might alter the virus reaction. Hybrid modifications, such as conversion to male sterility and fertility restoration, have in some instances contributed to added MDM susceptibility.

TABLE 1.—Average Performance of Corn Hybrids Grown in Four Replications Near Portsmouth, Ohio, in 1969.

Hybrid No. or Pedigree	Yield per Acre	Moisture at Harvest	Stand	Lodging		Days to Half Silk	Ear Ht.	MDMV Rating	MDMV Rating
				Stalk	Root				
Yellow Kernels	Bu.	%	%	%	%	No.	In.	8-27	9-10
Pioneer 3182	89.8	27.8	99	15	1	71	44	4.8	4.0
Pioneer 3188	81.7	26.8	98	26	1	73	39	5.8	5.5
Pioneer X5475	104.1	31.5	99	24	0	70	42	4.0	3.0
Hiser S88	104.2	25.2	100	21	0	69	40	4.3	5.0
Hiser VR996	79.2	24.7	99	28	0	72	39	6.0	5.5
Williams W100	74.2	24.8	100	35	1	70	41	5.5	4.8
Kenworthy K411	89.6	25.1	100	26	4	70	37	4.8	5.3
Kenworthy K465	67.5	26.6	97	39	1	72	41	5.5	6.0
Kenworthy K502	83.5	25.2	100	31	0	69	35	5.3	5.0
Crow Exp. 778	112.6	24.8	100	7	5	68	41	3.3	4.3
Funk Bros. G4761	102.8	30.3	99	9	0	71	40	3.0	3.3
Funk Bros. 22337	60.0	24.9	98	59	0	69	39	5.8	5.5
Funk Bros. 23413	105.7	33.6	99	0	0	73	40	2.5	3.0
Landmark C897XX	77.9	23.7	99	26	1	68	36	6.3	6.0
Mark Exp. 1W	83.4	28.2	99	21	0	73	41	6.0	5.0
Mark Exp. 4W	72.4	24.8	100	26	1	71	39	5.3	5.5
P.A.G. SX-17	100.3	25.0	100	31	0	71	43	4.3	3.8
P.A.G. 439	93.9	24.0	99	24	0	72	41	4.3	4.3
Whisnand 835	77.9	24.9	98	45	1	69	39	6.3	5.0
Burgdorf B-88-3X	70.1	25.0	99	35	2	71	39	6.0	5.8

TABLE 1 (Continued).—Average Performance of Corn Hybrids Grown in Four Replications Near Portsmouth, Ohio, in 1969.

Hybrid No. or Pedigree	Yield per Acre	Moisture at Harvest	Stand	Lodging		Days to Half Silk	Ear Ht.	MDMV Rating	MDMV Rating
				Stalk	Root				
	Bu.	%	%	%	%	No.	In.	8-27	9-10
Burgdorf B-837	54.7	23.9	100	41	0	70	36	7.8	6.8
(B37 x Oh514) (N7B x Mo12)	81.9	24.8	99	33	0	69	42	4.8	4.3
(Va35 x C103) (N7B x Oh514)	86.6	24.8	100	32	0	69	42	5.3	4.3
(Va35 x B54) (N7B x Oh514)	82.7	23.8	99	39	0	66	40	5.3	3.8
(Cl.38B x Va35) (Mo12 x Oh7B)	101.9	26.1	98	9	1	70	39	4.3	4.5
(B37 x H73) x Oh514	67.2	24.3	100	46	0	67	41	5.5	4.8
White Kernels									
Moews 898W	75.8	26.0	99	14	2	73	39	6 3	6.0
Moews 3359W	80.7	25.9	100	24	3	73	42	5.5	5.5
Moews 5559W	80.9	30.8	99	14	1	74	41	5.8	5.0
Mark M22W	79.1	27.9	100	26	0	73	39	5.5	5.5
Mark M92W	75.8	25.4	98	26	0	72	39	7.3	6.5
Mark Exp. 2W	31.4	25.8	98	56	0	72	32	8.8	7.8
Mark Exp. 3W	76.8	26.8	99	19	0	74	41	5.5	5.8
Ruff RW23	82.3	25.2	99	24	0	70	40	5.8	5.3
Ruff RW24	69.1	27.2	98	29	1	72	38	5.8	5.8
Ruff Exp. RW26	84.5	25.7	99	33	0	71	51	5.0	4.8
P.A.G. Exp. 18807W	108.2	27.0	100	13	1	77	50	3.5	2.5
Burgdorf B-99AW	72.0	27.2	100	33	1	72	41	6.5	6.5
L.S.D. (5 % level)	13.5	2.4		21			5.1	1.7	1.4
Coefficient of Variation	11.8 %								

TABLE 2.—Average Performance of Corn Hybrids Tested Near Portsmouth, Ohio, for the 2-Year Period 1968-1969.

Hybrid No. or Pedigree	Yield per Acre	Moisture at Harvest	Stand	Lodging		Days to Half Silk	Ear Ht.	MDMV Rating	MDMV Rating
				Stalk	Root			Late August	Early Sept.
	Bu.	%	%	%	%	No.	In.		
Funk Bros. G4761	98.3	35.5	99	5	0	68	43	2.3	2.9
Kenworthy K411	88.4	28.8	98	20	3	67	41	4.1	4.6
Kenworthy K465	72.6	30.1	94	30	2	69	45	4.7	5.2
Landmark C897XX	84.9	28.0	98	19	3	66	41	4.7	4.4
P.A.G. SX-17	103.2	30.9	99	20	0	69	47	3.3	3.1
P.A.G. 439	97.4	28.7	98	22	1	68	44	3.7	3.8
Pioneer 3182	92.9	31.3	97	14	1	69	47	4.1	3.3
Pioneer 3188	91.4	30.6	99	16	1	69	43	4.4	3.9
Pioneer X5475	115.0	34.0	99	16	0	67	46	2.9	2.2
Ruff RW24 (White)	76.2	33.2	97	19	1	69	42	4.6	4.8
Whisnand 835	90.6	28.8	96	31	2	66	43	4.3	4.5
(Cl.38B x Va35) (Mo12 x Oh7B)	103.9	30.3	98	7	1	67	44	2.7	3.5
(B37 x Oh514) (N7B x Mo12)	91.0	28.7	97	25	1	66	46	3.9	3.7
Means	92.7	30.7	98	19	1	68	44	3.8	3.8

The State Is the Campus for Agricultural Research and Development

Ohio's major soil types and climatic conditions are represented at the Research Center's 12 locations. Thus, Center scientists can make field tests under conditions similar to those encountered by Ohio farmers.

Research is conducted by 13 departments on more than 6200 acres at Center headquarters in Wooster, ten branches, and The Ohio State University.

Center Headquarters, Wooster, Wayne County: 1953 acres
Eastern Ohio Resource Development Center, Caldwell, Noble County: 2053 acres
Jackson Branch, Jackson, Jackson County: 344 acres
Mahoning County Farm, Canfield: 275 acres
Muck Crops Branch, Willard, Huron County: 15 acres
North Central Branch, Vickery, Erie County: 335 acres
Northwestern Branch, Hoytville, Wood County: 247 acres
Southeastern Branch, Carpenter, Meigs County: 330 acres
Southern Branch, Ripley, Brown County: 275 acres
Western Branch, South Charleston, Clark County: 428 acres